What is claimed is:

1. A bone implant comprising a calcium phosphate precursor capable of forming poorly-crystalline hydroxyapatite *in vivo*, wherein the precursor has a calcium to phosphorous atomic ratio between about 1.2 and about 1.68, and wherein the implant has a compressive strength of at least about 60 MPa.

2. The bone implant of claim 1, wherein the implant is a machined article.

3. The bone implant of claim 1, wherein the precursor comprises a first calcium phosphate in intimate mixture with a second calcium phosphate, the second calcium phosphate having a different calcium to phosphorous atomic ratio than the first calcium phosphate.

4. The bone implant of claim 1, wherein the precursor comprises a first calcium phosphate in intimate mixture with a second calcium phosphate, the second calcium phosphate having a different crystallinity than the first calcium phosphate.

5. The bone implant of claim 4, wherein the first calcium phosphate is an amorphous calcium phosphate, and wherein the second calcium phosphate has greater crystallinity than the first calcium phosphate.

6. The bone implant of claim 5, wherein the first calcium phosphate has a calcium to phosphorous atomic ratio less than about 1.5.

7. The bone implant of claim 5, wherein the second calcium phosphate is selected from the group consisting of dicalcium phosphate dihydrate, calcium metaphosphate, heptacalcium phosphate, tricalcium phosphate, calcium pyrophosphate dihydrate, calcium pyrophosphate, and octacalcium phosphate.

8. The bone implant of claim 7, wherein the second calcium phosphate is dicalcium phosphate dihydrate.

9. The bone implant of claim 1, further comprising a biocompatible polymer powder.

10. The bone implant of claim 9, wherein the implant has a compressive strength of at least about 120 MPa.

11. The bone implant of claim 1, further comprising a biocompatible polymer fiber.

12. The bone implant of claim 11, wherein the implant has a compressive strength of at least about 120 MPa.

13. The bone implant of claim 1, wherein the implant has a compressive strength of at least about 120 MPa.

14. A bone implant comprising a calcium phosphate precursor capable of forming poorly-crystalline hydroxyapatite *in vivo*, wherein the precursor has a calcium to phosphorous atomic ratio between about 1.2 and about 1.68, and wherein the implant has a porosity between about 5% and about 30%.

15. A bone implant comprising a calcium phosphate precursor capable of forming poorly-crystalline hydroxyapatite *in vivo*, wherein the precursor has a calcium to phosphorous atomic ratio between about 1.2 and about 1.68 and a particle size less than about 125 μm.

16. A bone implant comprising:

(a) a first calcium phosphate that is an amorphous calcium phosphate; and

(b) in intimate mixture with the first calcium phosphate, a second calcium

phosphate having greater crystallinity than the first calcium phosphate;

wherein the overall calcium to phosphorous atomic ratio is between about 1.2 and about 1.68; and

wherein the implant has a compressive strength of at least about 60 MPa.

17. The bone implant of claim 16, wherein the first calcium phosphate has a calcium to phosphorous atomic ratio less than about 1.5.

18. The bone implant of claim 16, wherein the second calcium phosphate is selected from the group consisting of dicalcium phosphate dihydrate, calcium metaphosphate, heptacalcium phosphate, tricalcium phosphate, calcium pyrophosphate dihydrate, calcium pyrophosphate, and octacalcium phosphate.

19. The bone implant of claim 18, wherein the second calcium phosphate is dicalcium phosphate dihydrate.

20. The bone implant of claim 16, further comprising a biocompatible polymer powder.

21. The bone implant of claim 20, wherein the implant has a compressive strength of at least about 120 MPa.

22. The bone implant of claim 16, further comprising a biocompatible polymer fiber.

23. The bone implant of claim 22, wherein the implant has a compressive strength of at least about 120 MPa.

24. The bone implant of claim 16, wherein the implant has a compressive strength of at least about 120 MPa.

25. A method of bone implantation comprising:

(a) providing a bone implant comprising a calcium phosphate precursor capable of forming poorly-crystalline hydroxyapatite *in vivo*, wherein the precursor has a calcium to phosphorous atomic ratio between about 1.2 and about 1.68, and wherein the implant has a compressive strength of at least about 60 MPa; and

(b) securing the bone implant at a site requiring implantation,

whereby the precursor undergoes conversion to poorly-crystalline hydroxyapatite at the implantation site.

26. The method of claim 25, wherein conversion of the precursor to poorly-crystalline hydroxyapatite is completed in a time between about 2 weeks and about 6 weeks after securing the bone implant at the implantation site.

27. The method of claim 25, wherein conversion of the precursor to poorly-crystalline hydroxyapatite occurs at about body temperature but does not proceed significantly at room temperature.

28. A method of bone implantation comprising:

(a) providing a bone implant comprising:

(i) a first calcium phosphate that is an amorphous calcium phosphate; and

(ii) in intimate mixture with the first calcium phosphate, a second calcium phosphate having greater crystallinity than the first calcium phosphate;

wherein the overall calcium to phosphorous atomic ratio is between about 1.2 and about 1.68; and

wherein the implant has a compressive strength of at least about 60 MPa; and

(b) securing the bone implant at a site requiring implantation,

whereby the first and second calcium phosphates undergo conversion to poorly-crystalline hydroxyapatite at the implantation site.

29. The method of claim 28, wherein conversion of the first and second calcium phosphates to poorly-crystalline hydroxyapatite is completed in a time between about 2 weeks and about 6 weeks after securing the bone implant at the implantation site.

30. The method of claim 28, wherein conversion of the precursor to poorly-crystalline hydroxyapatite occurs at about body temperature but does not proceed significantly at room temperature.

31. A method of spinal fusion comprising:

(a) providing a bone implant comprising a calcium phosphate precursor capable of forming poorly-crystalline hydroxyapatite *in vivo*, wherein the precursor has a calcium to phosphorous atomic ratio between about 1.2 and about 1.68, and wherein the implant has a compressive strength of at least about 60 MPa; and

(b) securing the bone implant between adjacent spinal vertebrae to promote fusion of the vertebrae.

32. A method of spinal fusion comprising:

(a) providing a bone implant comprising:

(i) a first calcium phosphate that is an amorphous calcium phosphate; and

(ii) in intimate mixture with the first calcium phosphate, a second calcium phosphate having greater crystallinity than the first calcium phosphate;

wherein the overall calcium to phosphorous atomic ratio is between about 1.2 and about 1.68; and

wherein the implant has a compressive strength of at least about 60 MPa; and

(b) securing the bone implant between adjacent spinal vertebrae to promote fusion of the vertebrae.